Plan to Conduct Red Team Reviews on GSFC Projects to be Launched in CY 00 (1/12/00)

Background

In the light of some recent NASA mission failures and the resulting Failure Review Board findings, the NASA Administrator has requested that the Center Director conduct critical Red Team Reviews on each of the Center's missions prior to the mission launch. This plan was developed as a response to the Administrator's request.

The Administrator wants each review to go beyond a review of the project documentation of what was done and into technical aspects of the program and the remaining risk. Some of the projects have already been subject to External Independent Readiness Reviews (EIRR's). These projects need not be subject to a full Red Team Review but instead will receive a Delta Red Team Review that will capture those items not already covered by the previous EIRR.

By agreement with the Kennedy Space Center, these reviews will cover the mission launch vehicle as well and KSC will provide the appropriate management and technical expertise support for the reviews and will recommend an independent, launch vehicle cognizant person to serve on the Red Team.

Scope

All GSFC missions scheduled to be launched in CY 00 will be subject to the review process as described in this plan. Specifically the following missions are involved:

February
- IMAGE *---------PI Mode

April
- SAC-C----------International
- EO-1----------GSFC Program

May
- GOES-L *---------GSFC Program

June
- TDRS-H *---------GSFC Program
- CLUSTER-II------International

July
- HESSI----------International/PI Mode
- QUIKTOMS------GSFC Program

August
- NOAA-L----------GSFC Program

October
- TIMED----------PI Mode

November
- MAP----------GSFC Program

December
- EOS-PM----------GSFC Program

* Indicates projects that have already conducted an EIRR and will therefore be subject to a Delta Red Team Review only.

The mission elements to be addressed by the Red Team Reviews and the depth that each element will be addressed to shall be as follows:

- Spacecraft/Instruments/Initial operations safety-fully addressed
- Launch vehicle integration-fully addressed
- Launch vehicle mission unique changes-fully addressed
- Unique-to-mission operations-fully addressed
- Launch vehicle core design and implementation-addressed on a mission/situation issues basis only
- SOMO/institutional mission operations-addressed on a mission unique requirements basis only
- Mission science operations-limited to systems needed for data capture only

Review Process Concept

The Red Team Reviews shall consist of a critical technical implementation and operations review on each individual mission from the perspective of looking at what could go wrong and cause the mission to be less than fully successful. Specific key processes used by the project in the implementation of the mission shall be reviewed. The results of some of these key processes will be reviewed and assessed as well. From this information the Red Team shall identify and document all remaining risk that could be in-line with complete mission success.

In order to obtain consistency a single dedicated Red Team staffed by experienced technical and program management experts shall be assembled for the implementation of these reviews. The team will have a membership that is independent of actively working GSFC personnel. Although a core team is planned to be maintained, specific discipline expertise will be added to each review as appropriate. The core team, which will include independent launch vehicle expertise recommended by the KSC, will function as an overview team that will assign functions and work to specialized technical teams as appropriate. The core team however, is responsible for the implementation of these Red Team Reviews and shall direct the project and the technical teams as necessary.

Each Project shall be required to assemble all pertinent information (using specific formats) and present that information to the Red Team. It is expected that each review shall take one to two days on a typical mission, with an additional two weeks allocated for deliberations and additional data requests and final report preparation by the Red Team. The Red Team shall have the authority to request that the Project prepare all necessary documentation and other records to enable and otherwise support these reviews. The Project shall also arrange for the cognizant peer review and systems review chairpersons to present the methodologies and findings of the individual peer reviews to the Red Team.

Review Process Specifics

Addressing all of the in-scope mission elements as specified above, the Project (or KSC for the launch vehicle related portions) shall present assemble and present data in specified formats, that addresses (or provides) the following:

1. The level, competence and independence of technical peer reviews that were performed on each of the elements and components.

2. The performance, level and independence of system level reviews that were conducted.
3. The level and thoroughness to which the test and verification program was implemented. The test and verification program at all levels from black box to spacecraft and integrated mission shall be detailed. This shall also include the V&V and IV&V processes used on software.
4. The level of mission assurance that was imposed on the implementation of the mission. This shall include parts usage as well as workmanship standards imposed. It shall also address the software assurance processes implemented.
5. The systems management imposed and implemented the mission. This shall include the performance and thoroughness of analyses, requirement management, systems engineering, software metrics, configuration management, documentation and technical record-keeping and workmanship and test process management.
6. Factors such as staffing and the experience of the implementing organization.
7. The results of the test and integration process of all of the hardware and software elements of the mission. This shall include information on the review and assessment of all failures and anomalies and their resolution.
8. Information on the failure free as well as the total operating time on all mission critical hardware and software.
9. The results of the technical review process shall be detailed. It shall include an assessment of all RFA's and the Project responses to those RFA's.
10. The amount, level and fidelity of mission simulations and launch/operations training that was done or is planned to be done to prepare the mission for launch and on orbit operations.
11. Provide a subsystem level Failure Modes and Effects Analysis.
12. Provide a mission requirements Verification Matrix that shows the pre launch verification of the mission level requirements. This matrix shall address both the fidelity and type of verification.
13. Identify all single point failures and provide a subjective assessment of the probability of each such failure mode causing a mission failure. Also provide adequate rationale to substantiate the subjective assessment.

In reviewing the above items, the Red Team will focus on implementations that could contain unevaluated risk to mission success.

In performing this task, the Red Team shall do the following:

1. Document the above review investigations in a summary matrix that indicates actual level of performance achieved on each of the above items. This should take into account the level of difficulty and complexity of each mission. Each of these items shall be rated on a scale of 1 to 10 with 10 being a very superior implementation and 7 being judged as nominal expected for assuring a remaining residual risk judged to be categorized as low. Each and every lapse in adequate implementation (a scoring of 6 or lower), even if the overall implementation is judged as being adequate, shall be identified and documented and judged under Item #2 below. Potential viable mitigation of remaining risk shall also be addressed if applicable.
2. Ascertain and document all residual risks, judged to be any level higher than low, that are remaining in the mission. Provide recommendations on methods and implementations to mitigate these identified higher-than-low risks.

3. Assess all single point failure mechanisms and provide a recommendation on the acceptability of non-acceptability, with appropriate rationale for each judgement.
4. Provide a full report of all of the above to the Center Director and the Goddard Program Management Council within two weeks of conducting each review. This report shall also have the Project provided FMEA and Verification Matrix attached.
5. An overall mission risk statement, along with the justification for that statement shall be made in the report.